

COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR FISCAL YEAR 2008

THURSDAY, MARCH 15, 2007

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 2:04 p.m., in room SD-138, Dirksen Senate Office Building, Hon. Barbara A. Mikulski (chairman) presiding.

Present: Senators Mikulski, Shelby, Stevens, and Alexander.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

STATEMENT OF HON. MICHAEL D. GRIFFIN, Ph.D., ADMINISTRATOR

STATEMENT OF SENATOR BARBARA A. MIKULSKI

Senator MIKULSKI. Good afternoon, everybody, and welcome to the subcommittee hearing of Commerce, State, Justice. The topic today will be the appropriations for the National Aeronautics and Space Administration (NASA). As we have said earlier, the subcommittee was focusing on innovation, security, and accountability. Once again, we feel that NASA is the premier innovation agency within the United States Government.

We know that more inventions, technology, and patents have come out of NASA than I think is ever fully grasped or fully appreciated by the American people, and certainly at times by people who wear green eyeshades.

Today we are going to hear from the NASA Administrator, Dr. Mike Griffin, about the agency budget and priorities. Since our hearing last year, a NASA civil servant, Dr. John Mather, a civil servant at Goddard, won the Nobel Prize, the New Horizons Mission has given us new spectacular pictures of Jupiter on its way to Pluto. Cassini continues to send its images from Saturn, and good old Hubble keeps plugging away, continuing extraordinary contributions to science even though it is running a little low these days. We have successfully and safely returned the Space Shuttle to flight and laid the foundation to return to the Moon and eventually to go to Mars.

For 2008, the President's budget funds NASA at \$17.3 billion, a 6.8-percent increase over the continuing resolution level. But when we look at the President's budget over the 2007 request, it is a 3-percent increase over last year. To put NASA's budget in perspec-

tive, a \$17.3 billion budget represents seven-tenths of 1 percent of the entire Federal budget.

As we looked at science funding we see inside the budget request, \$5.5 billion, a \$300 million increase over the continuing resolution, or a \$50 million increase when compared to the 2007 budget, the budget for science includes funding for Hubble servicing, the continuing development of the Webb telescope, and other missions. We are very, very pleased that these two will be in 2008.

I do see a significant problem with future science budgets because from 2008 to 2011 it only goes up by 1 percent, and we will be talking about that with the Administrator.

For Earth science, the budget shows a cut in funding starting next year, and by 2012 the budget for Earth science will be \$200 million less than in 2008.

Now, the exciting news is the National Academy of Sciences recently released its report on the future of Earth science, calling for new Earth science missions by NASA over the next decade, 14 of them, and also others to be done by the National Oceanic and Atmospheric Administration (NOAA) and one in conjunction. Though this year's NASA budget does not accommodate any of these new missions, we would like to discuss these with the Administrator, get his reaction, and try to find a way forward.

In 1988 the aeronautics budget at NASA was \$1.5 billion. Today it is \$554 million. Every commercial aircraft on-line today uses technology developed by NASA and we need to talk about our aeronautics program because, after all, when we look at its name, it is the national aeronautics, as well as the national space program.

The Space Shuttle budget is \$4 billion, the same as 2007 funding. The administration's budget calls for 14 additional flights to space, one to fix the Hubble. We just wonder how the Shuttle is doing. We know you have been hit by, was it, ice, hail? But our Space Shuttle returned to flight and the safety of our astronauts remains our number one priority. So we will be asking, how long can we keep the Shuttle going. And of course, like the Administrator, we do not want to be in the dark on the landing pad with a Shuttle return and not a way forward.

When we talk about exploration, it is a \$500 million increase over the continuing resolution funding and, quite frankly, we are disturbed about the continuing resolution funding. If Shelby-Mikulski had passed from the way we did the bill, we would have been in a better spot. But you know, we are where we are. We know that NASA estimates that it is going to cost \$16 billion to build Ares and Orion by 2012. We are concerned that there will be a 4-year delay between the retirement of the Space Shuttle and the launch of Orion and Ares. And look at it. The delay is not caused by Congress. As I understand, the President's plan also reflects this. But we do not want to delay any more than we can.

The Space Station will receive \$2.2 billion, an increase of over \$300 million, and we know we need to also have a way of resupplying it. So as we look ahead, there is no real growth in NASA's budget and there is no margin for error or overruns, and there is a lot of pressure on the NASA budget and on the Administrator on how to coordinate all the pieces that often need to move forward in what we hope is a balanced space program.

Senator Hutchison and I will work to increase the top line by \$1 billion and to repay NASA for the cost of *Columbia*. We also want to salute both Hutchison and Nelson, who are putting NASA in the President's authorizing legislation, putting NASA in the President's competitiveness agenda, and I will say more about that in my questions and answers.

But no matter how we look at it, we just think that we have too many good things for too little money and we are concerned about that.

We intend to, as always, pledge our bipartisan support to work with Senator Shelby, with the space Senators, to help balance the space program. But I remember over a decade ago President Bush's dad and then Vice President Quayle when they were contemplating the Space Station and some other breakthroughs on a very important Apollo anniversary invited us to the White House for a space summit, to kind of get a navigational chart on where we wanted to go in space and then what would be the revenue stream that we would talk about over multiple years.

I think it is time for another space summit so that we can talk over both the President's agenda, the need to continue our effort in space science and aeronautics and to make sure that our country is number one in innovation, always ahead in competition on new ideas and new technology, knowing that we have got to get to the Moon, know that China is looming out there, and at the same time continue the bold, bodacious space exploration that is characteristic of our program.

So having said that, it is just a direction to suggest and discuss, and as always I turn with real warmth and collegiality to my ranking member, Senator Shelby.

STATEMENT OF SENATOR RICHARD C. SHELBY

Senator SHELBY. Thank you, Madam Chair.

Dr. Griffin, thank you for joining us here today. This is an important hearing because it gives us on the subcommittee an opportunity to discuss the significant role of the National Aeronautics and Space Administration and its budget proposal. NASA's proposed budget for 2008 is \$17.3 billion. This is a \$1 billion increase to NASA's base programs or 6.5 percent over 2007 joint resolution funding level.

This is by some yardsticks a sizable sum, considering the funding constraints that the Federal Government faces in the coming fiscal year. But it is not too much money, Dr. Griffin, for what we want to do. The requested increase can be attributed to \$522 million for funding exploration systems which will enable NASA to return to the Moon, an additional \$652 million for the exploration capabilities account, which will allow for further construction of the International Space Station and other space operations.

While these are significant increases, the proposed budget also contains a reduction of \$336 million to aeronautics. Dr. Griffin, I think it is important to note that, while this budget reflects the President's implementation of the exploration vision, it is also grounded in NASA's 2007 request rather than the actual funding level provided in the 2007 funding resolution. This poses many dif-

difficulties for this subcommittee in developing its proposal for NASA funding in 2008.

There are many complex elements required to achieve the goal of returning to the Moon. No one knows this better than you, Dr. Griffin. First there are the preparatory missions, such as the Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite, which will launch, I understand, in October 2008. The follow-on mission, which is expected to launch around 2010 or 2011, has been selected since December 2005. Yet the 2008 budget continues to be vague regarding a time line for beginning the development work.

Delaying such preparation missions will only further delay man's return to the Moon. I understand that the preparatory lunar missions are moving forward and that the crew launch and crew exploration vehicles are well into their design and development work. Over the past year NASA has refined the Ares vehicle to be a five-segment solid rocket booster and selected the J-2X engine for its upper stage. This selection will make it possible for the Orion capsule to reach the Space Station and also be ready for a rendezvous with other vehicles for the trip to the lunar surface.

These are but a few examples of the ongoing work needed to make NASA's goals a reality. It is my hope, Dr. Griffin, that the implementation of the President's vision can be accomplished while maintaining the capabilities that NASA has developed in other mission areas. I do not believe that we should sacrifice missions and capabilities that will be vital to the future of exploration while trying to obtain this goal. I believe that we can and should find a balance here.

Much like last year's hearing, we are reminded today that the proposed plan for returning to the Moon is contingent on several factors. We are all keenly aware that any unexpected bump along the path could pose significant challenges to NASA's long-term plans. We can point to the sizable funding requirements of flying the Space Shuttle until it retires in 2010 and the ongoing construction of the International Space Station's heavy fiscal burdens on NASA's ability to continue down the path laid out in the vision for exploration.

The continual strains on NASA's budget require that we all work together as partners to ensure NASA can meet its many objectives.

Dr. Griffin, I am very interested in you discussing how NASA today will preserve its ongoing programs and how it will modernize its ongoing programs and how it will modernize its institutions and facilities which are critical to NASA's success in the coming years. I expect that we will have an ongoing dialogue over the course of the year about NASA's ability to achieve the Vision for Space Exploration.

I am also excited by the opportunities that lay ahead regarding the exploration vision at NASA. But I must point out the fiscal realities that you face every day that have and will continue to affect some of these efforts. NASA must show the same resourcefulness in operating within fiscal reality on the ground as it does in its innovation and can-do spirit for exploring space.

Dr. Griffin, I believe that the subcommittee has made every effort to work with you and we will continue to provide NASA with

the appropriate level of funding to ensure that roles and missions are protected and preserved. When such significant funds are provided, it is NASA's responsibility to have the systems in place to ensure that these funds are spent responsibly.

I am concerned that for the fourth year in a row NASA's financial systems have earned the worst rating possible from the administration. We were assured in our hearing last year that efforts were underway to fix these problems. Yet, according to the administration there has been little progress since we last met. In addition, the Government Accountability Office (GAO) has released its annual high risk report that focuses on programs with the greatest vulnerability to fraud, waste, and mismanagement. NASA has the unfortunate distinction, Dr. Griffin, of having been included in the 1990 inaugural edition for its contract management and remains on the high risk list to this day.

Finally, the annual audit of NASA's financial statement by an independent auditing firm does not bring me any comfort. NASA's finances were disclaimed in both 2005 and 2006 due to an inability to provide auditable financial statements as well as material weaknesses in its financial systems regarding the management of property and equipment. With such assessments of NASA's accounting, the agency's \$17.3 billion request should be backed up, I believe, by solid budget practices, not shoddy, unclear bookkeeping. I believe that NASA should be as committed to fiscal responsibility to this subcommittee, the Appropriations Committee, and the taxpayer as it is to your exploration mission, which we commend you for.

I think, Dr. Griffin, NASA must be better as far as what is going on with its books. I look forward, Dr. Griffin, to discussing how we may find a solution that keeps all of NASA's activities moving forward. It will be a difficult task, given the demands for funding across all of the agencies in this bill. The administration did not leave many crumbs on the table after making severe cuts to, among other things, NOAA and the proposed over \$1.5 billion in reductions to State and local law enforcement. But we are willing to work with you and the chairman to ensure that NASA receives the funds necessary to achieve the Nation's goals. We look forward to your testimony.

Senator MIKULSKI. Thank you.

Now I would like to turn to Dr. Griffin, but I also want to acknowledge—Senator, can you stay for the hearing then? I know you have a lot of pressures with Defense.

Senator STEVENS. We have a Defense hearing at 2:30. I will have to leave soon, but I would like to hear Dr. Griffin if possible.

Senator MIKULSKI. As soon as Dr. Griffin finishes, to accommodate you, Senator, shall we turn to you then for questions? Okay.

Dr. GRIFFIN. Senator, in deference to your time constraints today, I will keep my opening remarks short, but would like to enter my opening statement in the record along with my other formal statement.

Senator MIKULSKI. We also want to note this is the third day that you are testifying on NASA budget, two in the House yesterday, the authorizers and the appropriators, and this is the third.

ADMINISTRATOR GRIFFIN'S OPENING REMARKS

Dr. GRIFFIN. Thank you.

Chairman Mikulski, Senator Shelby, members of the subcommittee: I thank you for inviting me here today to discuss our \$17.3 billion fiscal year 2008 request. I am here today to seek your support for that request. The fiscal year 2008 budget request is 3.1 percent higher than that requested by the President for fiscal year 2007 and demonstrates his commitment to maintaining our Nation's leadership role in space exploration, scientific discovery, and aeronautics research.

But it supports many diverse priorities in these disciplines and so we need to allocate our resources carefully. In this we are guided by the NASA Authorization Act, our annual appropriations legislation, Presidential policy, and the decadal surveys of the national academies. But even so, we cannot afford everything that our many constituencies would like us to do. You will not find major strategic changes in the fiscal year 2008 budget request as compared to that for last year, but you will see some slight course corrections. Overall I think we are heading in the right direction and I think we have made great strides in the past year and we are on track and making progress in carrying out our tasks.

We have aligned NASA's aeronautics program with the first ever presidential policy on aeronautics research and development (R&D). The goal of this policy is to ensure that NASA and other agencies advance U.S. technological leadership in aeronautics.

We currently operate an armada of over 50 Earth and space science satellites and payloads today in orbit around the Earth, our Sun, and other planets. The fiscal year 2008 budget request provides the resources to launch 10 new science missions in that year, most of which involve international partners or other U.S. Government agencies. Our \$5.5 billion portfolio of Earth and space science accounts for almost 32 percent of the budget.

It is interesting to develop some perspective on this. During the 1960s, the decade of Apollo, science was 17 percent of the NASA portfolio. By the early 1990s, it had grown to 24 percent and today, as I said, it is 32 percent. In contrast, NASA's human space flight account during the Apollo years was 63 percent of the budget and is 62 percent today. So science is doing very well at NASA.

Now, our greatest challenge over the next few years is to fly the Space Shuttle safely while using it to finish the International Space Station and to do one final Hubble Space Telescope mission, and then transitioning to our new systems, the Orion crew exploration vehicle and the Ares 1 immediately thereafter.

Human space flight is a strategic capability for this Nation. We are now, as you know, facing about 4, 4½ year gap following Space Shuttle retirement when the United States will not have its own human space flight capability. Some in the Earth and space science community have called for further delays in NASA's human space flight efforts in order to allow more money to be set aside for science missions. I do not agree with this and, in fact, I often wonder what the community of scientists would say if they and not the human space flight community were facing a 4½ desert of opportunity.

If Orion is further delayed, we will be viewed by many as ceding our Nation's leadership in human space flight at a time when Russia and China have such capabilities and India has declared its intention to develop them.

In 1963 President Kennedy visited Redstone Arsenal in Huntsville and posed the following question: "I know there are lots of people now who say, why go any further in space. When Columbus was halfway through his voyage the same people said, why go on any further? What will we possibly find? What good will it be? They want to stop now. I believe the United States of America is committed to be first in space, and the only way we are going to be first in space is to work as hard as we can here and all across the country."

I love that quote for its endorsement of the necessity to stay the course.

So when you consider our fiscal year 2008 funding request, I ask you to consider our Nation's interests above the interests of any individual product, program, or constituency. The United States is a recognized leader in space because several successive Presidents and Congresses have worked together in the past to make the right strategic decisions, but this leadership is something we cannot take for granted.

PREPARED STATEMENT

I believe that our budget request today provides you with a carefully considered, balanced set of programs for our Nation's civil space effort, with world-class Earth and space science, strategic capabilities in human space flight, and U.S. technical leadership in aeronautics. We need the help of the Congress to provide the resources to maintain that leadership.

Thank you.

[The statement follows:]

PREPARED STATEMENT OF MICHAEL D. GRIFFIN

Chairman Mikulski and members of the subcommittee, thank you for the opportunity to appear today to discuss the President's Fiscal Year 2008 Budget request for NASA. The President's Fiscal Year 2008 Budget request for NASA is \$17.3 billion. This represents a 3.1 percent increase over the fiscal year 2007 request for the agency, but not the enacted fiscal year 2007 appropriation. The fiscal year 2008 budget request for NASA demonstrates the President's continued commitment to our Nation's leadership in space and aeronautics research, especially during a time when there are other competing demands for our Nation's resources. The fiscal year 2008 budget request reflects a stable plan to continue investments begun in prior years, with some slight course corrections. Overall, I believe that we are heading in the right direction. We have made great strides this past year, and NASA is on track and making progress in carrying out the tasks before us.

Before I outline the fiscal year 2008 budget request, I would like to address the status of NASA's plans for the use of fiscal year 2007 funding. On February 15, 2007, the President signed into law a joint resolution stipulating fiscal year 2007 funding levels for NASA and other Federal agencies. This appropriation represents a funding level that is \$545 million below the President's fiscal year 2007 request. The fiscal year 2008 budget request could not possibly factor the impact of this reduced level from the fiscal year 2007 request for NASA's carefully-considered multi-year programs, and thus, several programs in the fiscal year 2008 budget request will be impacted. The fiscal year 2007 appropriation further specifies funding levels in human spaceflight of that are \$677 million below the request—\$577 million of that from exploration systems. This reduction from the requested level may significantly impact our ability to safely and effectively transition from the shuttle to the Orion Crew Exploration Vehicle and Ares I Crew Launch Vehicle. It will have seri-

ous effects on many people, projects, and programs this year, and for the longer term. As I noted during last year's congressional hearings on NASA's fiscal year 2007 budget request, we have a carefully balanced set of priorities to execute on behalf of our Nation. So as a result of these funding levels that are less than the fiscal year 2007 request, NASA is carefully assessing the implications to overall exploration priorities and milestones, and will present detailed impacts after a full analysis is complete. The initial NASA operating plan for fiscal year 2007, which, we are endeavoring to finalize as soon as practicable, will reflect the impacts of less funding than planned and the requisite decisions. As always, we are here to carry out our Nation's civil space and aeronautics programs with the resources made available by the Congress. All of our programs proceed in a "go-as-we-can-afford-to-pay" manner; so if we receive less funding than requested, we will adjust our pace. Our stakeholders have my commitment to continue to keep them informed as to what I believe is the best approach to carrying out NASA's space and aeronautics research missions with the resources provided. In this determination, I will be guided by the NASA authorization acts, annual appropriations acts, presidential policy, and the decadal survey priorities of the National Academy of Sciences. If we determine that there is an agency objective that we will be unable to meet, I will inform our agency's stakeholders, including this subcommittee.

Highlights of the NASA Fiscal Year 2008 Budget Request

The fiscal year 2008 budget request for NASA is a carefully considered and balanced request formulated over many months with the White House. Unfortunately, the Congress had not completed action on the fiscal year 2007 budget at the time the fiscal year 2008 budget was being finalized, so the impact of the final fiscal year 2007 appropriation outcome is not accounted for in NASA's fiscal year 2008 budget request. The fiscal year 2008 budget request weaves together the Nation's priorities in space exploration, scientific discovery, and aeronautics research that will help fuel this Nation's future, creating new opportunities for scientific benefit, economic growth, national security, and international cooperation.

The greatest challenge NASA faces is safely flying the Space Shuttle to assemble the International Space Station (ISS) prior to retiring the shuttle in 2010, while also bringing new U.S. human spaceflight capabilities on-line soon thereafter. We must understand that, given proper goals, human spaceflight is a strategic capability for this Nation, and we must not allow it to slip away. In January, we remembered those whom we have lost in the exploration of space. In the aftermath of the Columbia tragedy, President Bush addressed the NASA workforce, saying, "In your grief, you are responding as your friends would have wished—with focus, professionalism, and unbroken faith in the mission of this agency." We must commit ourselves to the focus of professionalism and unbroken faith every day in order to carry out the tasks before us.

In analyzing not only the root causes, but also the systemic reasons behind the Columbia accident, the Columbia Accident Investigation Board (CAIB) made critical observations that guided the formulation of our present civil space policy. I fear that with the passage of time and the press of other concerns, we may be losing sight of some of these principles, so let me reiterate some of them here today. First, the CAIB noted that, "The U.S. civilian space effort has moved forward for more than 30 years without a guiding vision." Second, "because the shuttle is now an aging system but still developmental in character, it is in the Nation's interest to replace the shuttle as soon as possible as the primary means for transporting humans to and from Earth orbit." Third, "the previous attempts to develop a replacement vehicle for the aging shuttle represent a failure of national leadership." And finally, the board noted that "this approach can only be successful: if it is sustained over the decade; if by the time a decision to develop a new vehicle is made there is a clearer idea of how the new transportation system fits into the Nation's overall plans for space; and if the U.S. Government is willing at the time a development decision is made to commit the substantial resources required to implement it."

Since then, the President, the Congress and NASA have charted a new course in U.S. civil space policy that addresses all of these points, and the President's Fiscal Year 2008 Budget reaffirms that commitment with the necessary funds for the space shuttle and the ISS. NASA will continue forward at the best possible pace with the development of the Orion and Ares I crew vehicles. However, due to the cumulative effect of previously underestimated costs to retire/transition the space shuttle and support the International Space Station, the reduction from the fiscal year 2007 request reflected in the fiscal year 2007 continuing resolution, and the maturing design and integrated flight tests baselined for the Constellation program, it is unlikely that NASA will be able to bring these new exploration capabilities on-line by 2014. Full funding of NASA's fiscal year 2008 exploration systems request

is critical to ensuring the gap between retirement of the space shuttle and the new U.S. human spaceflight capability does not grow longer. If the gap in our human spaceflight capability extends even further than already planned, I believe our Nation will be ceding leadership in human spaceflight at a time when China and Russia have their own indigenous capabilities and India is developing its own capabilities. If we do not quickly come to grips with this issue, America may have a prolonged gap between the end of the shuttle program and the beginning of Orion and Ares I operational capability, a gap similar to the one that occurred from 1975 to 1981 when our Nation transitioned from Apollo to the space shuttle.

NASA has a lot of hard work ahead of it and many major milestones this year and next. The transition from the space shuttle to the Orion and Ares launch vehicles over the next several years must be carefully managed, and we must be focused, professional and committed to our mission. This is NASA's greatest challenge, and I ask the subcommittee's help in meeting it.

In the important area of Earth science, we recently received the first-ever Decadal Survey for Earth science from the National Academy of Sciences, which NASA, the National Oceanic and Atmospheric Administration (NOAA), and the United States Geological Survey (USGS) requested in 2003. As the first of its kind, the survey has drawn considerable attention, and we will observe the programmatic priorities for Earth Science which it advocates. In addressing the survey's Earth science priorities, and consistent with ensuring that NASA maintains a balanced portfolio of science as directed by the NASA Authorization Act of 2005 (Public Law 109-155), we have added funding to the Global Precipitation Measurement (GPM) mission, the follow-on to the highly successful Tropical Rainfall Measuring Mission (TRMM), to improve our ability to keep this mission on schedule. Our plan is to launch the first core satellite for the GPM mission not later than 2013, followed by the second Constellation spacecraft the following year. The fiscal year 2008 budget request also augments funding for the Landsat Data Continuity Mission (LDCM) and Glory missions in order to help keep those projects on schedule. Within planetary sciences, funding has been identified for Lunar science research project beginning in fiscal year 2008 to leverage the many opportunities for payloads on NASA and other nations' lunar spacecraft, such as India's Chandrayaan-1, as well as to analyze the science data from these missions, including NASA's Lunar Reconnaissance Orbiter. In 2008, we will launch a host of Heliophysics missions, many with international and interagency partners, to analyze the effects of solar flares, coronal mass ejections, and galactic cosmic rays. In Astrophysics, the final Hubble servicing mission is currently planned for a space shuttle flight in September 2008. And, as I advised the Congress and the science community last summer, NASA has reinstated the Stratospheric Observatory for Infrared Astronomy (SOFIA) mission. Though we know of no technical showstoppers in regard to the airworthiness of the aircraft or operation of the telescope, this program has some remaining hurdles to overcome and so remains subject to a management review later this spring. NASA will launch or participate in seven science missions in fiscal year 2007, followed by 10 missions in fiscal year 2008, resulting in many new Earth and space science discoveries in the years ahead.

The fiscal year 2008 budget request increases the budget profile for Aeronautics Research over the President's fiscal year 2007 request, aligns our aeronautics activities with the President's recently issued Aeronautics Research and Development Policy, and advances U.S. technical leadership in aeronautics. NASA has made significant progress in reformulating its approach to aeronautics research by collaborating with the broad research community including industry, academia, and other government agencies including the Federal Aviation Administration (FAA) and the Department of Defense (DOD). Through these changes, NASA will help ensure that America continues to lead the way in aeronautics research.

NASA continues to monitor and manage our "uncovered capacity" (employees not directly assigned to specific projects and programs). A little over 18 months ago, nearly 3,000 of NASA's 19,000 employees were designated as "uncovered capacity." Today, largely with the work defined in the Constellation program, we have greatly reduced that problem to manageable levels. As of February 2007, we have fewer than 200 uncovered capacity employees in fiscal year 2007 and fiscal year 2008. More importantly, many of our best engineers are working diligently on the great challenges before us. Every NASA center is now vested in our space exploration mission. While we are proud of the progress that has been made, significant human capital challenges remain. These include matching available skills with the important work to be done, managing attrition, retraining and hiring, and improving our workforce planning for future years in fiscal year 2009 and beyond. To address these challenges and any potential impacts resulting from the fiscal year 2007 funding re-

ductions, we have established a new intra-agency Workforce Planning Technical Team.

In addition, beginning in fiscal year 2007, the agency revised overhead allocations to simplify how we manage under full cost accounting. These changes will ensure a uniform cost rate for all NASA civil servants across the agency's government field centers. All changes are revenue-neutral to programs and projects; none of NASA's missions gain or lose funding as a result of this accounting change. At first glance, this accounting change appears to reduce the Aeronautics Research budget because so much of that work is done at our smaller research centers. However, in actuality, NASA's direct spending for Aeronautics Research has increased in the fiscal year 2008 budget runout by \$205 million through fiscal year 2011 compared to the fiscal year 2007 budget runout.

Beyond our budget request, NASA is beginning to transition the workforce, infrastructure, and equipment from the space shuttle to new exploration systems. Many of our most experienced people will be considering retirement between now and 2010. We will need the means to manage this attrition in a targeted manner to achieve better alignment of the workforce with our mission without creating unwanted losses and skills imbalances. One tool we may be using is the authority for the agency to be able to re-employ selected retirees without an offset to their annuity—thus giving them an incentive to see a project or program to completion. To assist employees with transition to the private sector, and to ease that upheaval, another tool would authorize NASA to continue their coverage under the Federal Employees Health Insurance for 1 year after departure.

We will also need better tools to manage the transition of our facilities. The agency is proposing slight changes and expansion to existing authority to permit leasing of underutilized facilities and related equipment. The agency would retain the proceeds of those leases to be deposited in a NASA capital asset account and invested in activities to improve and sustain our facilities and infrastructure. We plan to discuss the details of these legislative requests with members of Congress in the weeks and months ahead.

The remainder of my testimony outlines the fiscal year 2008 budget request for NASA in greater detail.

Science Mission Directorate

This past year was truly remarkable for science discovery about the Earth, Sun, solar system, and universe. NASA was responsible for 11 percent of Science News magazine's top stories (covering all fields of science) for 2006, which is an all-time record in the 34 years of tracking this metric. NASA's findings ranged from new observations of familiar phenomena like hurricanes, thunderstorms, and rainfall, to the identification of 16 new extra-solar planets orbiting distant stars near the center of our galaxy. As NASA continues to add observations from long-lived assets such as the Spirit and Opportunity Mars Exploration Rovers, it continues to successfully develop and launch the next generation of missions and to support a vigorous scientific community.

In 2006, NASA launched four new science missions, one technology demonstration mission, and partnered with other Federal and international agencies to launch three other science and technology missions, as well as the GOES-O satellite, to bring the current total number of operational science missions to 52. In January 2006, we launched the New Horizons spacecraft to the planet Pluto. Scheduled to arrive at Pluto in 2015, the spacecraft made its closest approach to Jupiter in late February. With the April 2006 launch of the CloudSat and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) spacecraft, NASA added to the "A-train" of satellites flying in close proximity around Earth to gain a better understanding of key factors related to climate change. In October 2006, NASA's twin Solar Terrestrial Relations Observatories mission (STEREO) spacecraft were launched to help researchers construct the first-ever 3-dimensional views of the Sun. Although the two spacecraft will not return images until later this year, initial results from STEREO have provided us with an unprecedented look at solar activity. On February 17, 2007, we launched five Time History of Events and Macroscale Interactions during Substorms (THEMIS) microsatellites to study the Earth's magnetosphere, and we are on track to launch the Dawn mission to main belt of asteroids between Mars and Jupiter and the Phoenix Mars mission later this year.

NASA's fiscal year 2008 budget requests \$5.5 billion for the agency's science portfolio. This represents an increase of \$49.3 million (or 1 percent) over the fiscal year 2007 request and it will enable NASA to launch or partner on 10 new missions, operate and provide ground support for more than 50 spacecraft, and fund scientific research based on the data returned from these missions. For fiscal year 2008, NASA separated the Earth-Sun System theme into two themes: Earth Science and

Heliophysics, and programmatic responsibility for studies of Near Earth Objects is transferred to the Exploration Systems Mission Directorate.

The Earth science budget requests \$1.5 billion—an increase of \$27.7 million over the fiscal year 2007 request—to better understand the Earth’s atmosphere, lithosphere, hydrosphere, cryosphere, and biosphere as a single connected system. This request includes additional funding for the Global Precipitation Measurement (GPM) mission to improve schedule assurance in response to the high priority placed on GPM in the Decadal Survey. As the follow-on to the highly successful Tropical Rainfall Measuring Mission, NASA’s plans to launch GPM’s first Core satellite no later than 2013, followed by the second Constellation spacecraft the following year. The Earth science budget also includes increased funding for the Landsat Data Continuity Mission and Glory in order to help keep them on their schedules, and provides funds for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) to reflect instrument availability and launch delays. Funds are requested for continued development and implementation of the Ocean Surface Topography Mission to launch in 2008, the Aquarius mission to measure the ocean’s surface salinity to launch in 2009, and the Orbiting Carbon Observatory mission planned for launch in 2008. NASA will continue to contribute to the President’s Climate Change Research Initiative by collecting data sets and developing predictive capabilities that will enable advanced assessments of the causes and consequences of global climate change. Over the coming months, NASA will evaluate opportunities for implementing the recommendations of the National Research Council’s Earth Science Decadal Survey and responding to challenges to the continuity of climate measurements resulting from the Nunn-McCurdy recertification of the NPOESS program.

The Heliophysics budget request of \$1.1 billion will support 14 operational missions to understand the Sun and its effects on Earth, the solar system, and the space environmental conditions that will be experienced by astronauts, and to demonstrate technologies that can improve future operational systems. During fiscal year 2008, the Explorer Program will launch the Interstellar Boundary Explorer (IBEX) mission, focused on the detection of the very edge of our solar system, and the Coupled Ion-Neural Dynamics Investigation (CINDI) Mission of Opportunity conducted by the University of Texas. The Solar Dynamics Observatory (SDO) to study the Sun’s magnetic field will complete launch readiness milestones in fiscal year 2008 and is presently scheduled for launch in August of 2008. The Geospace Radiation Belt Storm Probes (RBSP) mission, presently in formulation, will undergo a preliminary design review and a non-advocate review in fiscal year 2008 in preparation for entering development in early fiscal year 2009. RBSP will improve the understanding of how solar storms interact with Earth’s Van Allen radiation belts. While the ST-7 and ST-8 missions are on track for launches in 2009, the New Millennium ST-9 mission, along with follow-on missions, is delayed.

The planetary science budget request of \$1.4 billion will advance scientific knowledge of the solar system, search for evidence of extraterrestrial life, and prepare for human exploration. NASA will get an early start on Lunar science when the Discovery Program’s Moon Mineralogy Mapper (M3) launches aboard India’s Chandrayaan-1 mission in March 2008, along with the Mini-RF, a technology demonstration payload, supported by NASA’s Exploration and Space Operations Mission Directorates and the Department of Defense, which may glean water in the Moon’s polar regions. In addition, the budget requests \$351 million from fiscal year 2008 to fiscal year 2012 for new Lunar science research, including missions of opportunity, data archiving, and research. The budget supports the Mars Exploration Program by providing for a mission every 26 months, including the Phoenix spacecraft, scheduled for launch in 2007, and the Mars Science Laboratory, with a launch scheduled for 2009. The Discovery Program’s Dawn Mission is scheduled to launch later this year, and the Mercury Surface, Space Environment, Geochemistry and Ranging (MESSENGER) spacecraft is already on its way to Mercury. Three Discovery Mission proposals and three Missions of Opportunity were selected in 2006 for Phase A studies, and the Discovery Program will invite proposals for additional new missions in 2008. With the New Horizons spacecraft continuing on its way to Pluto, the New Frontiers Program’s Juno Mission will undergo a preliminary design review and a non-advocate review in fiscal year 2008 in preparation for entering development. The New Frontiers Program will release its third Announcement of Opportunity (AO) in late 2008.

The Astrophysics budget requests \$1.6 billion to operate NASA’s astronomical observatories, including the Hubble Space Telescope (HST), Chandra X-Ray Observatory, and Spitzer Space Telescope, and to build more powerful instruments to peer deeper into the cosmos. HST is scheduled for a final servicing mission in September 2008 using the space shuttle Atlantis. Along with service life extension efforts, two

new instruments will be installed during the servicing mission that are expected to dramatically improve performance and enable further discoveries, including enabling some science observations that have been affected by the recent failure of the Advanced Camera for Surveys. After the servicing mission, HST will once again have six fully operational instruments (including a suite of cameras and spectrographs that will have about 10 times the capability of older instruments) as well as new hardware capable of supporting at least another 5 years of world-class space science. The ESA Herschel and Planck missions, both of which include contributions from NASA, will launch in fiscal year 2008 aboard an ESA-supplied Ariane-5. Kepler instrument and spacecraft integration and test will be completed in preparation for launch in November 2008, to determine the frequency of potentially habitable planets. The Gamma-ray Large Area Space Telescope (GLAST) will launch in fiscal year 2008 to begin a 5-year mission mapping the gamma-ray sky and investigating gamma-ray bursts. The James Webb Space Telescope will undergo preliminary design review and a non-advocate review in fiscal year 2008, in preparation for entering development. The SOFIA observatory has been reinstated. Though we know of no technical showstoppers in regard to the airworthiness of the aircraft or operation of the telescope, this program has some remaining hurdles to overcome and so remains subject to a management review later this spring chaired by the NASA associate administrator. The SOFIA program baseline will be finalized at that time.

Exploration Systems Mission Directorate

The fiscal year 2008 budget request for the Exploration Systems Mission Directorate (ESMD) is \$3.9 billion to support continued development of new U.S. human spaceflight capabilities and supporting technologies, and to enable sustained and affordable human space exploration after the space shuttle is retired in 2010. With this budget, ESMD will continue to develop our next-generation crew exploration vehicle, while also providing research and developing technologies for the longer-term development of a sustained human presence on the Moon. However, due to the cumulative effect of previously underestimated costs to retire/transition the space shuttle and support the International Space Station, the reduction from the fiscal year 2007 request reflected in the fiscal year 2007 continuing resolution, and the maturing design and integrated flight tests baselined for the Constellation program, it is unlikely that NASA will be able to bring these new exploration capabilities online by 2014. ESMD will also continue to work with other nations and the commercial sector to leverage its investments and identify opportunities for specific collaboration on lunar data and lunar surface activities. New human spaceflight development of this magnitude, such as the Orion Crew Exploration Vehicle, occurs once in a generation. The next 5 years are a critical period in our Nation's space flight efforts.

The Constellation program includes the Orion Crew Exploration Vehicle; Ares I, a highly reliable crew launch vehicle; Commercial Orbital Transportation Services (COTS) demonstrations of cargo and crew transport to the International Space Station; Ares V, a heavy-lift launch vehicle; spacesuits and tools required by the flight crews and; associated ground and mission operations infrastructure to support either lunar and/or initial low-Earth orbit (LEO) missions.

For fiscal year 2008, pending a full analysis of the fiscal year 2007 budget impacts, ESMD is on track to maintain its commitments for Ares I and Orion, and to continue meeting major milestones. This year Constellation will continue to mature and develop overall. Formulation of the Constellation elements will continue, leading to the preliminary design review in 2008, at which time the program will be baselined. NASA will conduct an update for the overall Constellation Systems Requirements Review (SRR) in 2007 after the completion of all the Program Element SRRs—the Orion Project recently completed its SRR on March 1, 2007. ESMD released the Ares I Upper Stage Request for Proposals (RFP) on February 23, 2007. The RFP for the Ares I Avionics Ring is scheduled for release in May 2007, with selection and contract award scheduled for November 2007.

Facility, equipment, and personnel transitions from space shuttle to Constellation will be the major emphasis of the fiscal year 2009 budget process. NASA transition activities are focused on managing the evolution from current operations of the space shuttle to future operations of Constellation and emerging commercial services, in a safe, successful and smooth process. This joint effort between the Space Operations Mission Directorate (SOMD) and ESMD includes the utilization and disposition of resources, including real and personal property, personnel, and processes, to leverage existing shuttle and International Space Station assets for NASA's future exploration activities. Formalized transition boards are working to achieve this outcome. A Human Spaceflight Transition Plan was developed in 2006; updates are

in work, and metrics for the plan are being refined and will be implemented in 2007.

In August 2006, NASA signed Space Act Agreements with Space Exploration Technologies Corporation, of El Segundo, California, and Rocketplane-Kistler, of Oklahoma City, Oklahoma, to develop and demonstrate COTS that could open new markets and pave the way for commercial providers to launch and deliver crew and cargo to the ISS. The Space Act Agreements establish milestones and identify objective criteria to assess their progress throughout Phase 1 of the demonstrations. In the fiscal year 2008 budget, funding for the purchase of crew and cargo transportation services, either from international partners or preferably from commercial providers, is transferred from ESMD to SOMD. COTS demonstration funding remains in ESMD to better exploit potential synergies with the Constellation Program.

With activities in the Advanced Capabilities program, NASA seeks to understand the space environment as it relates to human performance by addressing respective recommendations from the Exploration Systems Architecture Study that was conducted 2005. This included refocusing biomedical research and human life-support activities through new milestones and requirements to target the timely delivery of research products. Accordingly, ESMD created two new programs under Advanced Capabilities: the Human Research Program (HRP) to study and mitigate risks to astronaut health and performance and the Exploration Technology Development Program (ETDP) to enable future exploration missions and reduce cost and risk. Plans for 2008 include:

- Testing of prototype ablative heat shield materials, low-impact docking systems, and landing attenuation systems;
- testing of advanced environmental control systems on the ISS;
- developing a lightweight composite command module test article for the Orion;
- conducting studies to assess risks of long-term radiation exposure and continuing the use of the ISS as a testbed for studying human health and safety in space;
- spacecraft integration and testing in preparation for the Lunar Reconnaissance Orbiter (LRO) launch in October 2008;
- next-generation spacesuit capable of supporting exploration; and
- developing jointly with the U.S. Air Force the RS-68 engine that will be used on the Ares V.

Finally, the LRO and the Lunar Crater Observatory Sensing Satellite (LCROSS) to the Moon is planned to be launched in early fiscal year 2008. These dual-manifested spacecraft have completed critical design review and are currently in development. The science yielded from these missions will enable future outpost site selection and new information about the deep craters at the lunar poles. The LRO/LCROSS missions represent NASA's first steps in returning to the Moon.

Aeronautics Research Mission Directorate

In 2006, NASA's Aeronautics Research Mission Directorate (ARMD) conducted a significant restructuring of its aeronautics program, allowing NASA to pursue high-quality, innovative, and integrated research that will yield revolutionary tools, concepts, and technologies to enable a safer, more flexible, environmentally friendly, and efficient national air transportation system. As such, ARMD's research will continue to play a vital role in supporting NASA's human and robotic space activities. The reshaped Aeronautics Program content and direction is consistent with the National Aeronautics Research and Development Policy, signed by the President on December 20, 2006.

A primary goal across all of the programs in ARMD is to establish strong partnerships involving NASA, other government agencies, academia, and industry in order to enable significant advancement in our Nation's aeronautical expertise. Because these partnerships are so important, NASA has put many mechanisms in place to engage academia and industry, including industry working groups and technical interchange meetings at the program and project level, space act agreements for cooperative partnerships, and the NASA Research Announcement (NRA) process that provides for full and open competition for the best and most promising research ideas. During 2006, ARMD's NRA solicitation resulted in the selection of 138 proposals for negotiation for award from 72 different organizations representing 29 different States plus the District of Columbia. NASA's fiscal year 2008 budget request for aeronautics includes \$51 million for NRA awards.

In fiscal year 2008, the President's budget for NASA requests \$554 million for aeronautics research. This budget reflects full cost simplification, which significantly reduces the center overhead and infrastructure allocated to the aeronautics programs.

NASA's Airspace Systems Program (ASP) has partnered with the Joint Planning and Development Office (JPDO) to help develop concepts, capabilities and technologies that will lead to significant enhancements in the capacity, efficiency and flexibility of the National Airspace System (NAS). Such improvements are critical to meet the Nation's airspace and airports requirements for decades to come. In fiscal year 2008, NASA's budget request would provide \$98.1 million for ASP to conduct further research in operational concepts and human-in-the-loop simulation modeling that supports advancements in automated separation assurance capabilities. In addition, ASP will pursue enhanced development of airport surface movement trajectory models to provide a basis for optimized use of super density airports, integrated airport clusters, and terminals where demand for runways is high. Last year, ASP took an important step toward this goal by completing development of a system-wide operational concept that provides a detailed description of future NAS capacity enhancements while assessing the benefits of such system improvements. Key to the analysis of the operational concepts was program-developed tools such as the Airspace Concepts Evaluation System and the Future Air Traffic Management Concepts Evaluation Tool, both of which have successfully transitioned from NASA to the Federal Aviation Administration and the JPDO.

NASA's Fundamental Aeronautics Program (FAP) conducts research in the engineering and scientific disciplines that enable the design of vehicles that fly through any atmosphere at any speed. The fiscal year 2008 budget request, amounting to \$293.4 million, will enable significant advances in the hypersonics, supersonics, subsonic fixed wing, and subsonic rotary wing projects that make up the FAP. These projects focus on creating innovative solutions for the technical challenges of the future: increasing performance (range, speed, payload, fuel efficiency) while meeting stringent noise and emissions constraints; alleviating environmental and congestion problems of the Next Generation Air Transportation System (NGATS) through the use of new aircraft and rotorcraft concepts; and, facilitating access to space and re-entry into planetary atmospheres. A wide variety of cross-cutting research topics are being pursued across the speed regimes with emphasis on physics-based multidisciplinary analysis and design, aerothermodynamics, materials and structures, propulsion, aero-servo-elasticity, thermal protection systems, advanced control methods, and computational and experimental techniques. A number of key activities are planned for fiscal year 2007 and fiscal year 2008 including the launch of a sub-orbital rocket to conduct flight experiments in hypersonic boundary layer transition and re-entry shapes, the flight test of scale models of the X-48B Blended Wing-Body concept to assess this advanced unconventional airframe configuration for its potential to decrease aircraft noise while also improving performance, the evaluation of radical new concepts for variable-speed rotor technologies that can result in highly improved performance, and the evaluation of actively-controlled inlets for supersonic transports.

The fiscal year 2008 budget request for NASA's Aviation Safety Program (AvSP) is \$74.1 million. The four projects within the program (Integrated Intelligent Flight Deck, Integrated Resilient Aircraft Control, Aircraft Aging and Durability, and Integrated Vehicle Health Management) will develop cutting-edge tools, methods, and technologies with close coordination among them to improve the intrinsic safety attributes of current and future aircraft that will operate in the NGATS. In fiscal year 2008, the program will complete a study of human-automation technology that will improve safety during approach and landing operations by allowing for active operator assistance that maintains appropriate levels of workload and will be conducted to evaluate neural networks for direct adaptive control that will maximize adaptation to simulated in-flight failures while minimizing adverse interactions. At the same time, onboard sensor technology will be developed and validated to achieve significant improvement in measuring atmospheric water content that will improve the ability to detect the onset of potential icing hazards. Challenges related to aircraft aging and durability will also be addressed by developing models capable of simulating the initiation and propagation of minute cracks in metallic materials.

Finally, NASA's Aeronautics Test Program (ATP) will continue to safeguard the strategic availability of a critical suite of aeronautics test facilities that are deemed necessary to meet agency and national aeronautics needs. The fiscal year 2008 budget request for ATP is \$88.4 million, which will enable strategic utilization, operations, maintenance and investment decisions for major wind tunnel/ground test facilities at Ames Research Center, Glenn Research Center and Langley Research Center and for the Western Aeronautical Test Range support aircraft and test bed aircraft at Dryden Flight Research Center. In fiscal year 2006, NASA implemented procedures to ensure affordable and competitive pricing of its aeronautics facilities for use by other parties, including industry and university researchers. In fiscal year 2008, ATP plans to continue ensuring competitive prices for ATP facilities, reducing

a backlog of maintenance issues and investing in advanced technologies such as installing consistent angle of attack instrumentation at the research centers.

Space Operations Mission Directorate

This was an extraordinary year for the space shuttle and International Space Station (ISS) programs. NASA celebrated Independence Day 2006 by launching space shuttle Discovery on the STS-121 mission. The second of two test flights (the first was STS-114 in July/August 2005), STS-121 helped validate the improvements made to the space shuttle system since the loss of Columbia on February 1, 2003. The mission also marked the return of a complement of three crewmembers to the ISS. The space shuttle Atlantis (STS-115), which launched on September 9, marked a return to sustained space shuttle operations and placed NASA on track to completing assembly of the ISS by 2010. STS-115 delivered the critical P3/P4 truss to the ISS, which will provide a quarter of the power services needed to operate the completed research facility. The last flight in December 2006, STS-116, was devoted primarily to deactivating the electrical power systems on the U.S. segment of the ISS and making a series of electrical and coolant connections between the P3/P4 truss segment and the rest of the station. To do this, flight controllers at the mission control centers in Houston and Moscow uplinked over 17,900 commands to the ISS during the mission—all without a single unplanned or command error. STS-116 crewmember Robert Curbeam also set a record for the most spacewalks ever conducted by an astronaut on a single space shuttle mission, with four excursions totaling over 25 hours.

Operational activities onboard the ISS have continued into 2007, with a series of spacewalks that reconfigured the thermal system on the station and prepared us for future assembly tasks. The station is now able to provide additional power to the space shuttle, allowing two extra docked days, and we have connected permanent systems in place of temporary ones. The sequence of three complex spacewalks within 9 days also demonstrated capabilities we will need later this year to fully install Node 2 following its delivery on STS-120.

These mission achievements reflect the NASA team's dedication to safely and successfully flying out the space shuttle program and meeting our Nation's commitments to our international partners. The program's successes also led to the decision in October 2006 to move forward with plans for a final servicing mission to the Hubble Space Telescope (HST). Following an extensive review by the relevant NASA offices of all safety and technical issues associated with conducting such a mission, it became clear that an HST servicing mission could be carried out effectively and safely. While there is an inherent risk in all spaceflight activities, the desire to preserve a truly international asset like the HST makes doing this mission the right course of action.

The space shuttle fiscal year 2008 budget request of \$4.01 billion would provide for five shuttle flights, including four ISS assembly flights as well as the HST servicing mission. The ISS assembly flights include the launch of major research facility modules from the European Space Agency and Japan. The Canadian Special Purpose Dexterous Manipulator robotic system will also be flown in 2008. These flights are a major step towards fulfilling U.S. commitments to NASA's international partners as specified in the ISS agreements and the Vision for Space Exploration.

The fiscal year 2008 budget request includes \$2.24 billion for ISS activities. NASA has consulted with our international partners on the configuration of the ISS, and is working closely with them to determine the detailed plans for logistics required during and after assembly. The fiscal year 2008 budget request provides the necessary resources to purchase Soyuz crew transport and rescue for U.S. astronauts as well as progress vehicle logistics support for the ISS from the Russian Space Agency.

As the shuttle approaches its retirement, the ISS Program intends to use alternative cargo and crew transportation services from commercial industry. Once a capability is demonstrated in phase 1 of the Commercial Orbital Transportation Services (COTS) Space Act Agreements, NASA plans to purchase cargo delivery services competitively in phase 2 and will decide whether to pursue crew demonstrations. In the fiscal year 2008 budget, funding for the purchase of crew and cargo transportation services, either from international partners or preferably from commercial providers, is transferred from the Exploration Systems Mission Directorate to the Space Operations Mission Directorate. One item of significance in the fiscal year 2008 budget runout, especially in the out-years, is that it allows for increases to our previously estimated costs for purchasing commercial cargo and crew services to support the ISS, assuming these commercial services are successfully demonstrated and are cost-effective. Should costs for those services be greater than what is presently budgeted, NASA has accepted a management challenge to scale back on our

space operations costs and will curtail some of our robotic lunar exploration or long-term exploration technology development in the out-years. COTS demonstration funding remains in ESMD to better exploit potential synergies with the Constellation Program.

The space shuttle program's highest priority is to safely complete the mission manifest by the end of fiscal year 2010, using as few flights as possible. Working through formalized transition control board processes, the space shuttle program will also play a key role in coordinating the smooth transition of space shuttle assets and capabilities to the next generation of exploration systems without compromising the safety of ongoing flight operations. The greatest challenge NASA faces is safely flying the space shuttle to assemble the ISS prior to retiring the shuttle in 2010, while also bringing new U.S. human spaceflight capabilities on-line soon thereafter. There are a number of major transition milestones set for fiscal year 2008, including the transition of one of the four high bays in the vehicle assembly building and launch pad 39B to the Constellation Systems Program. Space shuttle Atlantis may also be retired in fiscal year 2008 after the HST SM-4 mission and its systems and parts would be used to support the remaining space shuttle orbiters, Discovery and Endeavour, during the program's last 2 years of operations. The fiscal year 2008 budget request reflects the current assessment of costs to retire the space shuttle. Over the next year, NASA will develop additional detail and refine our cost estimates for the transition.

The fiscal year 2008 budget also provides for the procurement of two additional Tracking and Data Relay Satellite System (TDRSS) satellites to replenish the Constellation. NASA projects that the availability of aging TDRSS satellites to support overall user demand will be reduced by 2009 and depleted by 2015. In order to continue to support all users, NASA must begin the procurement process immediately, with planned launches in fiscal year 2012 and fiscal year 2013. By replenishing the satellites, NASA will be able to meet overall user demand through 2016. The Space Operations Mission Directorate has partnered with non-NASA users to provide a proportionate investment in the replacement capabilities.

Cross-Agency Support Programs

The fiscal year 2008 budget request for activities within the Cross-Agency Support Programs (CASP)—education, advanced business systems, innovative partnerships programs, and Shared Capabilities Assets Program—is \$498.2 million. Within this amount, \$34.3 million is for the Shared Capability Assets Program (SCAP), which is designed to ensure that critical capabilities and assets (e.g. arc jets, wind tunnels, super computing facilities, rocket propulsion testing, etc.) required agency-wide are available to missions when needed. The fiscal year 2008 budget request for Advanced Business Systems, comprising the Integrated Enterprise Management Program (IEMP), is \$103.1 million. Fiscal year 2007 and fiscal year 2008 funding will support IEMP in implementing capabilities that improve NASA's tracking and accountability of its property, plant, and equipment; integrate human capital information, providing employees and management with new, secure tools for accessing personnel data, and planning and budgeting NASA's workforce; and, provide more relevant and accurate financial information in support to NASA's programs and projects. This funding also supports ongoing operations and maintenance of NASA's financial system and other agency-wide business systems.

For NASA's education activities, the fiscal year 2008 budget request totals \$153.7 million and sustains our ongoing commitment to excellence in science, technology, engineering, and mathematics (STEM) to ensure that our agency is equipped with the right workforce to implement the Vision for Space Exploration. NASA will continue the tradition of investing in education and supporting educators who play a key role in preparing, inspiring, exciting, encouraging, and nurturing the youth who will manage and lead the laboratories and research centers of tomorrow. NASA education is committed to three primary objectives to help improve the state of STEM education in our country: strengthen the Nation's and NASA's future workforce; attract and retain students in the STEM discipline and; engage the American people in NASA's missions through partnerships and alliances.

The Innovative Partnerships Programs (IPP) provides leveraged technology investments, dual-use technology-related partnerships, and technology solutions for NASA. The fiscal year 2008 budget request for IPP activities is \$198.1 million. The IPP implements NASA's Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs that provide the high-technology small business sector with an opportunity to develop technology for NASA. Recently, NASA has made some changes to the management structure of these two programs to better enable technology infusion and to increase the efficiency of the operations. IPP also manages the Centennial Challenges Program. NASA has already benefited

from the introduction of new sources of innovation and technology development even though the program is relatively new and no prizes have yet been awarded. In addition, ongoing and future prize challenges will continue to inspire brilliant young minds.

CONCLUSION

NASA has many challenges ahead of us, but we are on track and making progress in managing these challenges. The fiscal year 2008 budget request demonstrates commitment to our Nation's leadership in space and aeronautics research, and while we may face a significant funding reduction for fiscal year 2007, we will carry on, though not at the pace we had previously hoped.

I ask your help to ensure this Nation maintains a human spaceflight capability. Without stable funding as requested in this budget, we face the very real possibility of allowing that capability to slip away for the foreseeable future—even as other nations continue to develop similar capabilities.

I also need your help to effectively transition key elements of our space shuttle workforce, infrastructure, and equipment to our Nation's exploration objectives. The provisions I referenced earlier, as well as stable funding, will help ensure we preserve a critical and unique industrial base capability that has allowed the United States to lead the world in space exploration.

Again, thank you for the opportunity to appear before you today. I would be please to respond to any questions that you may have.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PRESIDENT'S FISCAL YEAR 2008 BUDGET REQUEST

[Budget authority, dollars in millions]

By Mission Directorate	Fiscal year 2007	Fiscal year 2008	Fiscal year 2009	Fiscal year 2010	Fiscal year 2011	Fiscal year 2012
Science, Aeronautics and Exploration:						
Science:						
Earth Science	\$1,469.6	\$1,497.3	\$1,539.7	\$1,500.7	\$1,411.2	\$1,353.2
Heliophysics	\$1,028.1	\$1,057.2	\$1,034.5	\$1,107.1	\$1,241.2	\$1,307.5
Planetary Science	\$1,406.1	\$1,395.8	\$1,676.9	\$1,723.9	\$1,738.3	\$1,748.2
Astrophysics	\$1,563.0	\$1,565.8	\$1,304.2	\$1,268.9	\$1,266.2	\$1,393.8
Subtotal, Science	\$5,466.8	\$5,516.1	\$5,555.3	\$5,600.6	\$5,656.9	\$5,802.7
Exploration Systems:						
Constellation Systems	\$3,232.5	\$3,068.0	\$3,451.2	\$3,784.9	\$7,666.0	\$7,993.0
Advanced Capabilities	\$920.0	\$855.8	\$861.6	\$973.0	\$1,059.1	\$1,083.9
Subtotal, Exploration Systems ...	\$4,152.5	\$3,923.8	\$4,312.8	\$4,757.8	\$8,725.2	\$9,076.8
Aeronautics Research: Aeronautics Technology	\$529.3	\$554.0	\$546.7	\$545.3	\$549.8	\$554.7
Cross-Agency Support Programs:						
Education	\$167.4	\$153.7	\$152.8	\$152.7	\$149.8	\$149.6
Advanced Business Systems	\$97.4	\$103.1	\$69.4	\$71.6	\$67.6	\$67.5
Innovative Partnerships Program ...	\$215.1	\$198.1	\$197.2	\$199.8	\$200.0	\$200.0
Shared Capability Assets Program	\$22.1	\$34.3	\$34.2	\$36.2	\$37.3	\$37.2
Continuing Resolution Rate ¹	(\$555.60)	.....	.....	.....	.....	.....
Subtotal, Cross-Agency Support Programs	\$502.0	\$489.2	\$453.5	\$460.4	\$454.7	\$454.4
Total, Science, Aeronautics and Exploration	\$10,650.6	\$10,483.1	\$10,868.4	\$11,364.2	\$15,386.5	\$15,888.6
Exploration Capabilities:						
Space Operations:						
Space Shuttle	\$4,017.6	\$4,007.5	\$3,650.9	\$3,634.4	\$116.2	.....
International Space Station	\$1,762.6	\$2,238.6	\$2,515.1	\$2,609.2	\$2,547.5	\$2,600.8
Space and Flight Support	\$328.1	\$545.7	\$544.3	\$382.0	\$372.9	\$377.2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PRESIDENT'S FISCAL YEAR 2008 BUDGET
REQUEST—Continued

[Budget authority, dollars in millions]

By Mission Directorate	Fiscal year 2007	Fiscal year 2008	Fiscal year 2009	Fiscal year 2010	Fiscal year 2011	Fiscal year 2012
Continuing Resolution Rate ¹	(\$40.9)	.....	.....	.....	.....	.....
Total, Space Operations	\$6,108.3	\$6,791.7	\$6,710.3	\$6,625.7	\$3,036.6	\$2,978.0
Inspector General	\$33.5	\$34.6	\$35.5	\$36.4	\$37.3	\$38.3
Continuing Resolution Rate ¹	(\$2.0)	.....	.....	.....	.....	.....
Total	\$16,792.3	\$17,309.4	\$17,612.2	\$18,026.3	\$18,460.4	\$18,905.0
Year to Year Change ² (percent) .....	.....	3.1	1.8	2.3	2.4	2.4

¹ Fiscal year 2007 column represents the 2007 President's Budget in full-cost simplification and shown in the new Theme structure.

² Modification to fiscal year 2007 if current continuing resolution is extended for entire year, and assuming \$126.1 million institutional mission support transfers from Exploration Capabilities to Science, Aeronautics and Exploration not included in totals.

Totals may not add due to rounding.

Senator MIKULSKI. I have also read your written oral testimony particularly, and I appreciate, in the interest of time, pages 4, 5, and 6, which I think go to the meat of the issues around the continuing resolution, the way forward, flashing yellow lights about what will be done when, and workforce impact issues, which I know are of keen impact to not only those who are currently here, but to certainly extensive conversations with Senator Shelby, Senator Sessions, Senator Hutchison, and Senator Nelson, which goes to essentially where we are in this year's appropriation.

I am going to ask you a question and if you feel comfortable answering it, fine. If not, I understand. But my question is, when we look at 2008 what did you ask for from the Office of Management and Budget (OMB) and therefore what did you get that we would also have to take into consideration, not only in terms of the increase that was in the President's budget? Because the 3 percent just kind of keeps us almost at inflation.

Dr. GRIFFIN. That is correct, ma'am. I am not able to delve into discussions that go on within the Executive Office of the President. I will say that everyone gets a full opportunity to air their views. I've got mine. Ultimately decisions are made and when the President signs his name to that budget it becomes his submission, and I work for him and must support that.

Senator MIKULSKI. Dr. Griffin, I respect that and I respect that confidentiality. But that is also—see, I think the President has a vision of where he wanted to go and I think you are in alignment with that vision. But I think that there is a gap here with the OMB view of the vision, which is why I would like us all to get in the room as kind of a space summit. And I say that in the most friendly way. It worked so well with the President's father and Vice President Quayle.

Let me move—so just know, I think we all know where we want to go. It is how can we get there.

Dr. GRIFFIN. I admire and am very grateful for the support that you have given to the space program on a bipartisan basis, regardless of who is in charge when, and I know that that will continue.

Senator MIKULSKI. Sure.

Dr. GRIFFIN. Thank you.

HUBBLE SPACE TELESCOPE

Senator MIKULSKI. Let us go to the Hubble telescope. What is the current launch date for the Hubble servicing mission and does your fiscal year 2008 budget fully fund the servicing mission?

Dr. GRIFFIN. Well, the current date is September 2008 for the Hubble servicing mission. The fiscal year 2008 budget, of course, does not support that because the fiscal year 2008 budget was prepared and submitted by me and determined by the OMB before we had ascertained that we could do the Hubble servicing mission. You were with me. We announced——

Senator MIKULSKI. I remember it.

Dr. GRIFFIN [continuing]. That last October. We had been hoping for a spring 2008 launch and what we have is a September 2008 launch, which is 4 months different, because of the necessity to first of all be certain that we could get the servicing mission hardware to the pad in time, and April or May would have been very dicey. Then second of all, we wanted to have a launch on need capability if there were a rescue mission.

Senator MIKULSKI. Dr. Griffin, I know we have talked about this.

Dr. GRIFFIN. Right, okay. Sorry.

Senator MIKULSKI. Safety of the astronauts. What I hear is that you have the financial resources——

Dr. GRIFFIN. So I need to find \$40 million in the astrophysics budget and I will do that.

Senator MIKULSKI. But it is a \$40 million price tag which is not now currently in the 2008 framework; am I correct in that?

Dr. GRIFFIN. That is correct, ma'am.

Senator MIKULSKI. So we will have to work together on that. And again, we are just identifying kind of a must-do list that we need to go down.

EARTH OBSERVING SENSORS

Now, I found interesting your commentary on the science budget, now 32 percent, which carries us through, of course, 2012. But at the same time, what we are concerned about is these years into the future, one of which is 40 percent—now let us go to Earth observing. Forty percent of the Earth observing sensors now in orbit are going to kind of end by the end of the decade unless they are replaced.

As you look ahead, is there money now in this year's appropriation to make a down payment on replacing these sensors? Do you see replacing these sensors? Where do you see going with that?

Dr. GRIFFIN. You, of course, ask a very good question.

Senator MIKULSKI. That is our bread and butter, am I correct, apart from new ideas and new National Academy of Sciences recommendations?

Dr. GRIFFIN. We certainly have to keep in place the Earth sensing, climate resource programs and the data. The continuity of the data is crucial and we have to keep that in place. Now, I need to take you back for just a moment to decisions made some years ago that all of this climate research capability would be put on the national polar-orbiting operational environment satellite system

(NPOESS) program, which is a Department of Defense (DOD), NOAA, and NASA program. So NASA climate research dollars were diverted to NPOESS.

Now, NPOESS breached the Nunn-McCurdy and so the climate research sensors will not be on that. So we have asked the National Academy of Sciences for a study; and we are doing ourselves a study to determine, for OSTP, how we are going to recover from the loss of climate information that was to be provided by NPOESS and how we are going to incorporate that into the Earth science program.

We will have those studies by some time this spring. We will be factoring that into our planning for the 2009 request and beyond, because we have to adapt now to a changed set of circumstances that we did not anticipate.

Senator MIKULSKI. Well, I know my time has expired, but with the indulgence of my ranking member, because he and I thought—we had NOAA in here last week, I think, and we were pretty robust in our questioning around the need for accountability on NPOESS. We are very disappointed at the enormity of the overrun, the fact that we were glad that the McCurdy stepped in, but now we asked Admiral Lautenbacher, what are you going to do about this and how are you going to implement the recommendations.

But as you know, it was a three-headed thing. It was NOAA, NASA, and the Air Force. I do not think we would ever go for that kind of thing again. But where do you see yourselves coming in, not only with the loss of Earth science capability, but then also for the fiscal stewardship necessary for both your role that when NPOESS flies you are still going to be involved, “you” meaning NASA, is still going to be involved with NPOESS.

So where do you see your fiscal stewardship? And then when this happens in May, we do want to talk to you about climate change, the climate crisis, because I think we all agree this is where the American people want us to be working as well.

Can you help us out here?

Dr. GRIFFIN. Well, we absolutely intend to discuss with you the recommendations that come out of these two studies in connection with how we will continue our climate research.

Senator MIKULSKI. That is how we are going to continue the research. But you know, it was not only NOAA that dropped the ball on the NPOESS. The Air Force played a big role in this and so did NASA.

Dr. GRIFFIN. NASA does not have money in the NPOESS program.

Senator MIKULSKI. But you were all part of developing the NPOESS and they, as they look at some of the issues here, feel that it was also NASA that played a role, as did the Air Force, in part of these overruns. Are you with me?

Dr. GRIFFIN. I hear what you say and I understand you, but I do not think that NASA had any role in the NPOESS overruns and shortfalls.

Senator MIKULSKI. Well, I do not want to use my time going down this path, but when we talked with Admiral Lautenbacher last week, and we talked with him both publicly and I had a conversation with him about it, because this is really a big ticket item,

as you know, about what was our way forward. He seemed to also feel that there was a NASA role. So we need to be able to talk about this and talk about it, so it is not only about the climate change.

But I am going to turn to Senator Shelby and Senator Alexander. I will come back with some more of this.

MANNED FLIGHT OF ORION VEHICLE

Senator SHELBY. Thank you, Madam Chairman.

Dr. Griffin, you have indicated that unless there are additional funds provided in the next few fiscal years to NASA that the first manned flight of Orion will not be until 2015 perhaps, instead of 2014 as called for in the recent NASA authorization bill. The additional funds beyond those already in the budget that would be required to have an operable replacement for the Shuttle I understand would be \$350 million in 2009 and an additional \$400 million in 2010.

In response to the funding levels provided by NASA for 2007, does NASA anticipate making any supplemental requests or sending a budget amendment to the subcommittee in the months ahead to try to make up this shortfall?

Dr. GRIFFIN. We are discussing within the administration what the way forward is, but I cannot say at this time. I simply do not know whether we would be making an amended request or change plans going forward.

PRECURSOR PROGRAM FOR LUNAR EXPLORATION

Senator SHELBY. Senator Mikulski and a number of us that support NASA believe you need more money for what you are called upon to do. Lunar precursor missions. In 2005 the NASA authorization act directed NASA to institute a robust precursor program for lunar exploration. In December 2005, NASA awarded a follow-on mission, the RLEP as it was called then, to a team from the Marshall and Goddard Space Flight Centers, with Marshall as the lead.

Last year before the subcommittee you stated that this mission would be done in a timely way as a precursor mission, but would not start until 2007. In your hearing with the House Appropriations Committee early this week, it was my understanding that you mentioned that all the information NASA will need for a return to the Moon can be obtained from orbit. This seems to indicate that the precursor mission will never happen. If I am wrong, can you correct me on that?

Can you explain if the requirements have changed between 2005 and today and align that position with the direction of NASA's authorization language for having a robust precursor program? In other words, what is the current status of this?

Dr. GRIFFIN. The information that we feel that we need—and this conclusion has been reached in discussion with our NASA advisory councils, science groups, as well as internally—the conclusions we have reached are that the information we need before putting people back on the Moon can be obtained with lunar reconnaissance orbiter. The surface science and technology that we

would like to do is something we would like to do, but it is not essential.

Because funding is very tight, we have a choice between doing lunar surface science and technology with robotic precursors early on. If we do that, we will delay the development of the Ares launch vehicle and the Orion crew vehicle by another 6 months. So if I undertake that work, I will delay Orion and Ares even further. That is work not yet started, and so when budgets are tight my normal first choice is to delay work not yet started rather than to cancel work, and my normal choice is to delay work which is nice to have but not essential, and that is what we will be doing here.

PROPULSION RESEARCH AND DEVELOPMENT

Senator SHELBY. In the area of propulsion, we talked about this before. The Vision for Space Exploration will require many new technologies and systems to be developed in order to maximize our investment on returning to the Moon. One of these areas will require ongoing research and development in this area of propulsion. Marshall Space Flight Center has expertise in this area and has continued working on propulsion systems from the time of the last missions to the Moon to the present.

As the work continues on the research and development on Vision-related vehicles and systems, what do you anticipate will be the need for propulsion research and development this year and in the future?

Dr. GRIFFIN. I do not need propulsion research to get back to the Moon. I need propulsion systems development, if you will, and that is going on at the Marshall Space Flight Center and through its contractors, and they are doing, frankly, a very good job. I am quite pleased with them. They will be busy with the redevelopment of the Nation's space propulsion capabilities for an upper stage and rocket capabilities for the foreseeable future.

So Marshall is fully occupied helping us first replace the Shuttle and then after that return to the Moon. I would like to say, believe me, I would very much like to be doing advanced research in propulsion. But as with other things in the budget, there is a difference between must have and nice to have, and right now what I must have is working propulsion systems, and what would be nice to have is advanced propulsion research.

AGING NATIONAL AERONAUTICS AND SPACE ADMINISTRATION INFRASTRUCTURE

Senator SHELBY. Dr. Griffin, a lot of the NASA facilities have aged and deteriorated, as you well know. A lot of us believe there is significant need for infrastructure. Do you have any plan for that? What can we do to help you? I know we are the money Committee to appropriate money. We have those challenges at Marshall. You have them at Goddard, you have them at Kennedy Center, you have them in Florida.

Dr. GRIFFIN. Sure. Sir, most of the NASA infrastructure, as you know, is 40 some years old and more. Even at that, it is not as old as many other Government facilities, but that is as it is. We are working on an agency-wide facilities plan right now. It will be done shortly. We are working with the Office of Management and Budg-

et to finalize that, and it will cover the detailed data for the fiscal year 2008 construction of facilities, including repair, rehabilitation, renovation, replacement on existing systems, as well as any new things that we need.

It will describe about a little more than a \$6 million strategic initiative to address our facilities repairs and upgrades that are needed. Now, with regard to returning to the Moon, we are going to make every effort to use existing facilities. We would only propose building a new facility if something that the U.S. Government already owns just does not make the grade. But we will discuss that, the strategic plan, with you just as soon as we have it.

Senator SHELBY. Thank you very much.

Senator MIKULSKI. Senator Alexander.

EDUCATION PROGRAM

Senator ALEXANDER. Thank you, Madam Chairman.

Mr. Griffin, I want to ask you about a \$153 million item in the budget that is labeled "Education." I see that NASA's education themes are: one, to contribute to the development of science, technology, engineering, and math workforce in disciplines needed to achieve NASA's strategic goals; and two, to attract students and retain them in those disciplines. So it is teachers, workers, students—and students, I guess is what we are talking about.

Two years ago a group of us, including the chairman of this subcommittee, asked the National Academy of Sciences and the National Academy of Engineering, of which you are a member—

Dr. GRIFFIN. Yes, sir.

Senator ALEXANDER [continuing]. To tell us what are the top things we need to do in priority order to keep our brainpower advantage in this country. They assembled a distinguished group and gave us 20 specific items in priority order. And items A-1 and A-2 were the same things as your themes. In other words, one, is annually recruit 10,000 science and math teachers by awarding scholarships, et cetera; and two, is strengthening the skills of 250,000 existing teachers through training and education programs. So what I want to ask you is, in order to keep our jobs in this country, keep growing them, if we wanted quickly to recruit more math teachers and strengthen the skills of existing math teachers and inspire students in math and science, your \$150 million is already at work toward that objective. How effective are you at that? And specifically, how many teachers, how many students, do you touch each year? And do you have any measures of how much they learn or what progress, how effective the programs are toward these goals? And have you invited your Academy of Engineering or scientists or other outside groups to look at this \$150 million and say, in light of these goals, which are now being incorporated into legislation that has been introduced and is likely to pass here by big bipartisan numbers, are we getting the biggest bang for our buck on this \$150 million in terms of new math and science teachers and outstanding teachers, especially with summer institutes and academies, which were highly recommended here as some of the most effective programs for training math and science teachers and aspiring students?

Dr. GRIFFIN. I do not know that we are. I have a new Assistant Administrator for Education. She has taken on the task of trying to link our spending to measurable goals and outcomes. When I rejoined NASA as Administrator, I too was unhappy with the indefinite nature of our education program. We are spending, as you see there, in round numbers around \$150 million or so every year on direct education, and we are spending another very substantial sum, in the low hundreds of millions, on education and public outreach as a part of our normal missions. So from all sources, NASA is spending literally hundreds of millions on education, and it would be nice to have it strategically oriented. I do not know that it is right now, but we are working on it and I would be more than pleased to provide an answer to you for the record on exactly what we are doing or a briefing to you or your staff.

[The information follows:]

SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM)

NASA is continually looking for ways to support science, technology, engineering and mathematics (STEM) education to compete effectively for the imaginations and career ambitions of America's young people. NASA also provides teachers with supplemental curricular materials for the learning environment in communities.

NASA has developed a number of innovative programs that use NASA's unique content, people and facilities to support educators in science, technology, engineering, and mathematics fields, and to inspire the next generation of explorers and innovators through the Vision for Space Exploration. Specific examples include:

Attracting students to the teaching profession

The NASA Educator Astronaut project uses the visibility and educational opportunities created by the activities of the Educator Astronauts to inspire greater K-12 STEM achievement, promote STEM careers, and elevate public esteem for the teaching profession. In selecting our Educator Astronauts, we identified hundreds of our country's top educators. We have captured their energy through the Network of Educator Astronaut Teachers (NEAT). Approximately 180 NEAT members are now in communities all across America conducting workshops (three annually) reaching about 90 educators per session. These efforts result in strengthening STEM skills of approximately 10,000 teachers annually. Additionally, professional development training engaging educators, their schools and communities in NASA education activities and informing them of NASA resources has taken place in 280 NASA Explorer Schools (NES) 17 Science, Engineering, Mathematics, Aerospace Academies (SEMAA), and 31 Aerospace Education Laboratories (AEL).

Providing pre- and in-service teacher training

NES provide intensive teacher training, the Aerospace Education Support Project (AESP) provides on site professional development to teachers in classrooms across the country. NES assist middle schools with improving teaching and learning in STEM education through significant structural (professional development, stipends, grants) and curricular support based on NASA resources. In 2006, 5,339 teachers received intensive training as part of the NES project. Additionally the AESP conducted sessions across the Nation, reaching 13,938 educators.

- Research Academy provides leading-edge research opportunities for faculty and students from Minority Institutions (MI) that compliment NASA's research programs and make original contributions to NASA in astrobiology, biotechnology, information technology, and nanotechnology. Faculty and students from MI collaborate with the scientists at NASA's Ames Research Center, industry, academia and nonprofit organizations on research that helps prepare the next generation of explorers for NASA missions.

- In addition to in-service workshops based on our missions, NASA is committed to the pre-service training of our future educators. Through the National Pre-Service Teacher Conference, Pre-Service Teacher Institutes and Online Professional Development, NASA recruits STEM teachers to develop the confidence and skills to effectively teach mathematics and science using cutting-edge technology and educational materials. Such efforts have led to 200 STEM-enhanced teachers instructing an average of 25 students per classroom times 3 years, impacting a projected total of 15,000 students.

- NASA's Digital Learning Network (DLN) fosters the effective use of interactive instructional technologies through the delivery of NASA educational content for the benefit of its students and educators. It also contributes to the professional development of internal and external educators through the delivery of face-to-face and distance learning-based events. Over 74,000 students, teachers and other participants were engaged in a DLN event last year.

Developing and distributing curricular support materials

Curriculum Improvement Partnership Award, a three-year undergraduate curriculum improvement program for minority institutions (MI), including Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges and Universities, and other MI, emphasizes improvements that are directly related to the NASA mission by infusing innovative learning experiences in STEM into the curriculum. NASA's Educator Resource Centers (ERC) conducted educator Resource Center Network 362 workshops in fiscal year 2006, helping 23,819 teachers learn about and use NASA's educational resources. Personnel at ERCs located throughout the United States work with teachers to find out what they need and to share NASA's expertise. The ERCs provide educators with demonstrations of educational technologies such as NASA educational Web sites and NASA Television. ERCs provide in-service and pre-service training utilizing NASA instructional products. Educators also have the opportunity to preview, copy and receive NASA instructional products.

Through an innovative partnership, NASA is collaborating with OfficeMax to provide educators with a convenient way to access NASA materials in the most economical, productive and efficient way. If educators require a document or material that is large quantity (number of pages), and doesn't have the resources to print them, OfficeMax will print materials and make them available at any of their nearly 1,000 stores across the country, including Puerto Rico and the Virgin Islands.

Supporting informal learning

The Museum Alliance provides near real-time access to NASA information from missions such as Cassini, Hubble and Mars, as well as Earth science resources, for use in museums and science centers across the country.

In collaboration with the American Museum of Natural History, dozens of activities and curricular support materials and lessons were adapted for use by the after school community.

Other examples of the unique innovative projects that NASA makes available to support students across our Nation and to inspire more students to pursue higher levels of study in STEM courses include:

- The Science Engineering Mathematics and Aerospace Academy Program (SEMAA) reaches K–12 minority students that are traditionally underrepresented in careers involving STEM. Students meet during school, after school or on Saturday mornings and during the summer to engage in hands-on, interactive learning sessions that are specifically designed for each grade level. Between the International Space Station, the space shuttle, sounding rockets and high altitude balloons, NASA's Education Flight Projects provide hands-on experiences to inspire and motivate students to pursue studies and careers in STEM through participation in NASA research applications. NASA is using its unique assets like the C-9 to allow students to study microgravity; we are launching student experiments more than 25 miles above the Earth on sounding rockets; and our astronauts make phone calls from 240 miles above Earth's atmosphere to students to involve them in current research aboard the International Space Station. All these opportunities take advantage of our flight hardware projects provide real, hands-on experiences to inspire the minds, imaginations, and career ambitions of America's young people.
- Teacher training for Worlds Beyond Our Own captures the excitement and discovery surrounding planetary exploration. NASA and the Johns Hopkins Applied Physics Laboratory developed workshops and materials to assist educators in capturing the excitement surrounding NASA's New Horizons mission to Pluto that launched in January 2006. New Horizons is the fastest spacecraft ever launched from Earth, on board one of America's most powerful rockets, and will be traveling the farthest distance of any NASA spacecraft to begin its primary mission. Students will grow up with this project. Today's elementary school students will be in college when this spacecraft encounters Pluto.
- Museums and Science Centers are developing activities and materials to inspire, educate, and engage students, educators and the general public. They are also hosting professional development opportunities for formal and informal education professionals across the Nation. For example, in 2005 NASA and the

Children's Museum of History, Natural History, Science and Technology in Utica, NY unveiled two new exhibits at the museum. The exhibits "Why We Explore" and "Space Station Imagination" provided an overview of the history and future of space exploration. Astronaut Ed Lu, a veteran Space Station astronaut, who spent six months aboard the International Space Station, hosted the unveiling.

- NASA's Great Moonbuggy Competition allows high school and college students' to race into the future and cross the surface of the moon without leaving the Earth. Teams from the United States and Puerto Rico design human-powered vehicles to compete in NASA's annual Great Moonbuggy Race. The race was inspired by the lunar rover vehicles astronauts drove on the moon during three Apollo missions. This year's event, opened to the media and public, was held April 13–14 at the U.S. Space & Rocket Center in Huntsville, Alabama.

In fiscal year 2005, through a variety of venues (distance learning, videoconferencing, events, competitions, face-to-face, Space Shuttle and ISS downlinks, workshops, and other activities NASA has reached more than 2.9 million students, (776,000 K–12; 50,000 higher education; 2,151,380 distance learning students) and 855,000 teachers. (Please note: the number of teachers represents not a number of the individuals that participated but a number of participation opportunities that were taken, many of which were taken multiple times by the same individuals.)

Educators who participated in NASA workshops and events provided feedback via the NASA Education Evaluation Information System (NEEIS) regarding the effectiveness and relevance of our efforts. With a 5.0 Likert scale in which "5" is the highest value, the average of the teacher participant ratings of NASA's workshops and resources was 4.67.

NASA's resources (teacher training programs, supplemental curricular materials, etc.) are aligned to national standards and complement other agencies efforts. Inter-agency forums, e.g. the National Science and Technology Council enable all STEM education focused agencies and departments to share information and best practices to promote complementary activities.

Additionally, NASA uses objective and verifiable performance metrics, regular management insight and review processes, and defined tools to assess its performance at all levels—portfolio, outcome, and the individual program/project/product/activity.

The Agency is working with other agencies, e.g., National Science Foundation to examine their evaluation techniques to determine applicability and best practices for assessing NASA's education portfolio, strategic outcomes, and projects.

In fiscal year 2006, the National Research Council (NRC) Board on Science Education began work under a contract with NASA to conduct an evaluation of NASA's precollege education program. An expert panel was convened and the first committee meeting was held Nov. 15–17, 2006. A second meeting held on January 18–19, 2007. Three additional committee meetings will be held prior to the submission of the NRC's report, scheduled for November 2007. The NRC does not release preliminary results prior to submission of their report.

In addition to the NRC evaluation, other independent assessments, evaluations and program reviews of projects such as NES, AESP, EarthKam, and SEMAA are conducted annually by Paragon Tec Inc. (NES), Western Michigan University (AESP), Education Development Center for Child and Technology (EarthKam), and Benson Penick and Associates (SEMAA).

Senator ALEXANDER. Well, no, I would be—you can provide it to me, because I am very interested in it and would like to work with you. My son went to the space camp in Huntsville and that's an attractive way to inspire students. But if I may suggest, one outside group that may be useful to your assistant and to you as you measure the \$150 million might be the Augustine Group in the National Academies, because they spent a summer looking over a great many programs, looking at their effectiveness. That would be one source of input.

For example, the legislation that we have would increase the number of summer institutes at national labs. Well, I can think of no more inspiring place for math and science teachers in Tennessee to go for a 2-week session than an academy in Huntsville, to learn

new techniques for teaching math and science and to inspire them to do a better job.

You have so many degrees that you have enough degrees for the whole room here, so I know I am preaching to the choir. But just as an example, we are talking about very measurable numbers here. Governor Hunt of North Carolina, former Governor, told us that the University of North Carolina College of Education graduated three physics teachers last year for the entire State of North Carolina. I am sure the number in Tennessee is not much more. But just in our own region with that one activity in Huntsville, we could probably quadruple or double or even by a factor of more the number of teachers through summer institutes, academies, a variety of ways.

So I would look forward to working with you on that and following it over time, and I am delighted that you are there and that it is a priority of yours.

Dr. GRIFFIN. I would be interested in working with you on it and I am certain that if legislation is passed increasing the number of summer academies and institutes that we would be happy to be part of that. We would be thrilled.

MATH AND SCIENCE INSTITUTIONS

Senator ALEXANDER. Madam Chairman, and I am also suggesting that since they have recommended this as the single most important thing we could do to keep our competitive edge, ahead of research, ahead of the R&D tax credit, ahead of everything else, we might take some of that \$150 million you have now got and have some summer institutes for math and science teachers and students.

Dr. GRIFFIN. Well, much of the money that we are spending today is set aside for member preferences on how the education dollars are to be spent, and if it could be spent more strategically I would be, for one, I would be much in support of that.

Senator MIKULSKI. Dr. Griffin, now you know why Senator Shelby and I were so excited that Senator Alexander joined the subcommittee. We worked with he and Senator Domenici and Senator Bingaman last year to literally put into a legislative framework the rising above the gathering storm, and he came on this particular subcommittee because of his passion really to implement the triad of increased research, increased opportunities in education to get people excited about science, and number three, a more innovation-friendly government.

Who is your new assistant for education?

Dr. GRIFFIN. Her name escapes me right now.

Senator MIKULSKI. Mary, do you want to?

Dr. GRIFFIN. Oh, thanks. Dr. Joyce Winterton. I am sorry. She just recently came on board and I met her only once.

Senator MIKULSKI. No, I know you've got a lot on your mind. This is like sitting for your oral exams for your doctorate. We go from one topic—no, we understand.

Dr. GRIFFIN. No, that was easy. This is much tougher.

Senator MIKULSKI. What we would like to suggest is that the new Administrator meet with Senator Alexander, because you are right, in previous years education has been gushy and where there

is a vacuum members step in. So now I think we would like to make wise and prudent use of that \$150 million and we can see the benefits. Certainly the NASA relationship with the Maryland Science Center has been a cornucopia of running opportunities both for teachers and for students.

But we would like to really make good use of this because, again, NASA is where it is at. It is—what I said to the President about being in the innovation-competition agenda, competitiveness agenda. It is NASA through its technology, through Hubble, to its space exploration program, that really excites people about science. And we have got all these young little geniuses out there who want to participate in October Sky, while we, of course, do our appropriations.

SPACE SHUTTLE RETIREMENT

So moving on, though, to like some nuts and bolts again, Shuttle retirement. What I am concerned about is what happens if the Space Station is not finished by 2010 and you are ready to retire the Shuttle? Do we anticipate that the Shuttle really will be done by—excuse me, the Space Station, that the Space Station will be done by 2010? And do you really believe that it will, but do you have a contingency plan? What is the consequences of the contingency plan?

Dr. GRIFFIN. We have dealt with that in a couple of ways. First of all, I do believe that the assembly schedule accommodates ample margin to finish the assembly of the Space Station with the Space Shuttle by 2010. It was planned that way. When I came back to NASA, we did not have a plan that accommodated a reasonable schedule reserve to finish the Space Station by 2010, nor did we have the budget for it. So we tightened our belt on the human space flight side of the house and we deferred, as many have regretted and as I regret, we deferred some of the utilization of the Space Station in the next few years in order to focus on assembling it.

So our average flight rate over the years, including time out for two losses due to accidents, has been $4\frac{1}{2}$ flights per year. We are on that pace now again. We are doing well, and if we continue that pace we will finish with ample margin. So I do believe we can do that.

Now, the consequences—

Senator MIKULSKI. Do you envision any scenario that would keep the Shuttle going after 2010?

Dr. GRIFFIN. I do not. In fact, at some point years ahead of your last flight you have to buy your last tank, your last solid rocket boosters. We've done that. So we do not envision a scenario in which we would continue to fly past 2010. Now, the last couple of flights have been arranged so that they are the least crucial flights, and so if it were necessary to drop a flight or two we would still have the assembly complete. Some of our logistics would not be delivered and we would have to find some other means of commercial transport to put those up. In fact, that is what we plan to rely on between 2010 and when the crew exploration vehicle (CEV) comes along, is commercial transportation to the Space Station to deliver our supplies and other cargo.

ORION CREW RETURN VEHICLE/ARES LAUNCH VEHICLE

Senator MIKULSKI. We could have a robust conversation just on that. But I would like to give you the opportunity, because I know Senator Shelby as our other colleagues are very keenly interested in, of course, the Orion crew return vehicle and the Ares launch vehicle. That is the bread and butter. I mean, that is the—without that, space exploration will really just sputter.

The Orion of course, the safety of our astronauts, the crew return vehicle, and of course the launch vehicle. In your fall testimony, which was the part that I was reading, you talk about how, based on everything I know, due to the cumulative effect of reductions in the exploration system to pay for the Space Shuttle return, previously underestimated costs to fly the Shuttle until 2010, and the reduction in fiscal year 2007, you were concerned about, number one, the schedule that you now had, and number two, you also comment that you are not sure about what will be the workforce implications of all of this.

What I would like to do today with Senator Shelby and I here, do you want to elaborate on that, so we just kind of get it all out into the air? Right now we have just identified Hubble costs \$40 million. That is a chunk of money. Let us really talk about what it is going to take and what you would like to see in order that we meet—we understand, we do want Orion. We do want Ares, and we want it in as well-paced a way as you would, and I think the mission calls for.

So do you want to elaborate on your testimony, because I think this is the nuts and bolts of what colleagues are asking and what we are asking. So tell us how you see this and for you to elaborate on your testimony, and particularly also the work force implications, because some of our colleagues are apprehensive.

Dr. GRIFFIN. Yes, Madam Chairman. Would you like me to sort of walk you through how we got where we got?

Senator MIKULSKI. No, we know how we got where we are.

Dr. GRIFFIN. You know how we got there, okay. So you want to know what we need to go forward.

Senator MIKULSKI. Yes. We know how—it is kind of that same, we are where we are. So we know where we got, but we have got to get going. So let us talk about the got to get going.

Dr. GRIFFIN. Yes, Madam Chairman. I just wanted to make sure I understood what you wanted me to talk about. Accepting the intent of the Congress on the fiscal year 2007 continuing resolution, Senator Nelson and Senator Hutchison asked me what it would take to get back into 2014 with the CEV and the Ares and Orion. I said, after we studied it carefully, to replace the money that was not appropriated in 2007 would require \$350 million in fiscal year 2009 and \$400 million in fiscal year 2010, as close as we can estimate it. That would get us back to September 2014. I was also asked what it would take to get back into 2013 and, considering that again as carefully as we can, we believe that it is about \$100 million a month. So that should just be the way that you should think about it. Every month that you want to pull the schedule in is \$100 million.

The best we could do at this point would be to bring it back to June 2013. So June 2013 is where we are on a technical schedule.

Senator MIKULSKI. Technical. But as it stands now, based on the 2014, knowing earlier is always nice to hear, but we would be concerned about two things. Number one, what now as we look at 2008 in order to meet responsibilities, meet our responsibilities in 2008, and also what you need to do in terms of the fiscal mechanisms, not to be sure that we do not get into the overrun problem.

Dr. GRIFFIN. Of course, now——

Senator MIKULSKI. What do you need in 2008 to, say, meet a 2014?

Dr. GRIFFIN. I do not need anything additional in 2008.

Senator MIKULSKI. But for us to stay the course?

Dr. GRIFFIN. For us to stay the course. If you wished to pull the schedule in and stay the course and be in 2014, we would need money in 2009 and 2010. Of course, you know better than anyone that fiscal year 2009 preparation starts next month. So fiscal year 2009 is already upon us. But I do not need additional funds in fiscal year 2008. But I would need to know that funding would be coming along in fiscal years 2009 and 2010.

Senator MIKULSKI. But your point, though, is that in 2008, that if there is any shrinkage in 2008—and, of course, we are looking forward to what our allocation is going to be. This is why we are looking—you know, we are so glad the budget is going to be on the floor, that we know what our allocation is, because we presume that some time in May we will need additional conversations. We will know what our allocation is, we will know the direction.

But to be clear, if we stay the course in 2008 as recommended here, you will be moving while you are looking at 2009. And that is also if something unforeseen does not happen.

Dr. GRIFFIN. That is exactly correct, Senator. If I get the President's budget in 2008 and if the funding I mentioned in 2009 and 2010 were to be supplied, if you chose to do that, then we would be back on track. I will say for the record, our technical planning on these systems is very conservative. We are budgeting with new levels of conservatism. I have spoken of 65 percent confidence level budgeting. Paul has heard me and Art has heard me on this. So I strongly believe, that we can avoid future technical surprises in this. We are not developing new technology here. We are striving to restore lost capability. So this is not the time to develop new technology.

INDEPENDENT PROGRAM ANALYSIS ORGANIZATION

Senator MIKULSKI. Well, first of all, I know that many are talking about even if we could accelerate it another year. I want to be sure that there are mechanisms in place to make sure that Orion and Ares are properly managed. And I know you share that.

Do you have an independent oversight mechanism to verify cost, design, and technical feasibility?

Dr. GRIFFIN. Yes, we do. We have an entire independent program analysis organization that, in fact, does just such cost analyses, that is independent of the programs.

Senator MIKULSKI. I am sorry; who does that?

Dr. GRIFFIN. Again, it is our independent program analysis organization.

Senator MIKULSKI. So you have an internal red team?

Dr. GRIFFIN. Yes, Madam Chair.

Senator MIKULSKI. Is that kind of that in a nutshell?

Dr. GRIFFIN. We do. They are located at Langley or they are headquartered at Langley. They are independent of the programs and their estimates in fact have been quite reliable. It was they who brought to me the correct information regarding the underfunding of the James Webb Space Telescope a couple of years ago. So I have found them to be very good.

Senator MIKULSKI. We just needed to know what it was.

I just—I do not know if Senator Shelby has more questions, but when Shelby—when Senator Shelby moved the bill last year, I think, Senator, you had \$3.7 billion in there for this, which of course is very close to the President's budget. Had we been able to move our bill, I think we would be in good shape.

I know with the continuing resolution—and it has given heartburn to many of us, even the idea that we had to do one—there was \$400 million, so it was not a total loss. But it was enough of a loss for you to lose time, but you do not want to lose ground; is this right? And if we get back to where we are, I think we will have a way forward.

Dr. GRIFFIN. That is correct, Madam Chairman. I would again emphasize we will soon be making decisions with our contractor based on what money we can expect when. So if it is your intention—

Senator MIKULSKI. You know, when you talk about 2009 and 2010, I do not dispute this. I am glad to hear. Also there is the red teaming, which means—but we are not the only ones that need to hear this. And I know you are starting next month. This is why I would like for us to be in the room and say, we have got to talk about a couple of years here, how we can retire the Shuttle with honor and say goodbye, not be sitting on the launch pad for a prolonged period of time, but do it in a well-paced way, as well as to meet important scientific objectives that have been identified by both your team and the national academies.

AMERICAN COMPETITIVENESS INITIATIVE

Senator SHELBY. Thank you. Madam Chairman, I think we do need some type of summit with Dr. Griffin and others where we can just talk about what we really need, where you really want to go, and so forth, and see how we can help.

Dr. Griffin, ACI. I was surprised to see that NASA was not included as part of the American competitiveness initiative, ACI. The goals for the education component of NASA's budget are to strengthen the Nation's future workforce, attract and retain students in science and engineering, and to engage Americans in NASA's mission. Coupled with the high public visibility and recognition that you enjoy, it seems that NASA would be a natural fit for such an initiative.

It is troubling why NASA was not included in this initiative. It seems like it is a pretty good fit.

Dr. GRIFFIN. Well, yes, sir. In fact, much of what we do fits very naturally within the goals of the ACI. There may be some semantics involved here, but I think in a way that is a reason why NASA was not specifically included. We are already doing many of those things.

The ACI was also intended to provide additional budget for agencies which had not been receiving it, and from the administration's point of view NASA is already above the average level for domestic non-defense discretionary agencies.

Senator SHELBY. You have got a lot of brainpower, I think, that we could use.

Dr. GRIFFIN. Well, I hope we do.

Senator MIKULSKI. I would agree.

Dr. GRIFFIN. Well, we support your view that we at NASA do many things that are closely related to the goals of the ACI and we intend to keep doing those things.

CHINESE ASAT TEST

Senator SHELBY. China. I know that last summer you were in China to talk about their space program and so forth.

Dr. GRIFFIN. Yes, sir.

Senator SHELBY. As we are all aware, China recently conducted a test that destroyed a weather satellite in an orbit about 500 miles above the Earth. This test had to have created some space debris that eventually will fall or could fall to the Earth. But it would first have to pass through space occupied by the International Space Station and other valuable NASA assets. That is what I have been told.

I do not want you to touch on any classified information here, but what risk to NASA's assets was created by this test and could you relate that here, or would you rather defer that?

Dr. GRIFFIN. No, I can discuss that here, Senator. For the first few weeks after the Chinese ASAT test, the risk to the Space Station approximately doubled. Now, I would state correctly for the record that the average daily risk to the Space Shuttle from orbital debris is about 1 in 100,000. So the risk doubled from about 1 in 100,000 to 1 in 50,000.

After a few weeks, the debris had spread out and retreated into what the analysts refer to as the background. So after a few weeks that debris posed no measurable additional risk over the existing background that was already there. Nonetheless, of course, we deplore such tests because we now understand in a way that we did not some decades ago how dangerous that debris can be, and in fact China is part of international coordinating bodies whose goal is to mitigate such debris. So we do regret that test, but at this point it does not pose an additional threat to any space assets that we have.

STATUS OF THE EXPLORATION ACTIVITIES

Senator SHELBY. Dr. Griffin, for the record, could you give us a status of the exploration activities such as the Constellation program are progressing, would you specifically focus on crew exploration vehicle, the crew launch vehicle, and the launch operation aspects of the program? Could you do that?

Dr. GRIFFIN. Yes, Senator. The crew exploration vehicle—when I sat here with you a year ago we were in the middle of source selection. We said that we would select a winning contractor by Labor Day of that year, and we did. That winning contractor is Lockheed. We have spent the last few months working with them to scrub the design and definitize the requirements. That has gone quite well. They are on track and they are on target.

We with Senator Mikulski already discussed the impact of various delays, including the need to find additional money for the Space Shuttle last year and the continuing resolution this year. The accumulated effect of delays is to put us into 2015, which none of us want to be in, and both of you have expressed your desire to help with that and I appreciate it.

But the technical work on the CEV is on target. The Ares launch vehicle, which, as I think you know, is being developed under the leadership of a team at the Marshall Space Flight Center, is equally on target. They are doing just a great job. They have released the RFP, the request for proposals. Industry is now bidding on the upper stage development work for that vehicle. The first stage uses an existing development, the Shuttle solid rocket booster, which the project office for that exists at Marshall Space Flight Center. So we will be combining a second stage with an old first stage, and that will be the new crew vehicle.

The instrument unit for that will be procured in an RFP this October. So by the time the new fiscal year starts, we will have all the elements of Shuttle replacement under contract and in work. I am very pleased. We have teams at Marshall Space Flight Center and Johnson Space Center on that. I am very pleased.

Launch pad work has already started on Complex 39B to transition that from a Shuttle pad to a new Orion and Ares pad. Now, Senator Mikulski, as you and I have discussed, we will preserve the launch on need capability during the Hubble Space Telescope servicing mission. So we will not make modifications to Complex 39B which would interfere with the Shuttle launch, but we have started those modifications in non-interfering ways.

The team is excited. They are energized. This is affecting our educational posture because I spent 13 years as an adjunct professor. If I ever again have a life to call my own, I will go back to doing it. But my academic friends are telling me that their college students are excited and they are energized because they see a space program being reborn out there that they can join when they graduate from college, and they look ahead and they say, well, when I am 45 we will be going to Mars, and that is true. If we keep going with what we are doing, that is true. So work is going very well.

Senator SHELBY. Dr. Griffin, I do not believe you will be an adjunct professor unless you want to by choice. You will be a chaired professor somewhere.

Madam Chairman, thank you.

NATIONAL ACADEMY OF SCIENCES REPORT ON EARTH SCIENCE

Senator MIKULSKI. Thank you, Mister—thank you, Senator Shelby.

I just have one last question before we go. I know there are votes. I want those college kids when they are 45 knowing that we are on Mars, but I do not want them sitting at a kayak at Goddard because the bay has risen that far because of global warming.

Which takes us to the National Academy of Sciences report on Earth science. Dr. Griffin, as you know, they have recommended a robust agenda of 17 different projects to study climate and atmospheric and oceans issues along with NOAA, to really also focus on those things that would have societal benefit.

Do you want to tell us your reaction to this and how you would see—I know it is not in 2008, but how you would see incorporating this? And also, one of the things it calls for is a memorandum of agreement with NOAA to really maximize and leverage the respective work that both agencies are doing. Do you want to comment on that?

Dr. GRIFFIN. Yes, Madam Chairman, I would like to. I think the NASA-NOAA relationship is as good or better than it has ever been. Admiral Lautenbacher and I and our staffs talk frequently. We, as I said in an answer to one of your earlier questions, we recognize the need to replan our Earth science and observation and climatology work together, given the restructuring of NPOESS, and we will be doing that over this summer and we will be keeping you and your staffs informed as to how that is going.

We have a National Research Council study which is due to us to help with this issue, as well as a study that we are preparing for OSTP. We will factor in the results of the new decadal, which I would remind you, we asked for that decadal. So we now have their priorities for the work which should be done within Earth science, and in fact we used the midterm report on that to increase money to the global precipitation measurement mission, the GPM, which we will be doing in conjunction with the Japanese. So we are paying attention.

Senator MIKULSKI. I want to be very clear that the recommendations of the National Academy on Earth science for the climate crisis does not mean in any way to imply that you, meaning NASA and the Earth sciences have not already been looking at it.

Dr. GRIFFIN. Right.

Senator MIKULSKI. This is the look ahead. That is why they call it the decadal. That is like we are in the decathlon.

Dr. GRIFFIN. So we will be restructuring our Earth science portfolio, or we will be making certain that our Earth sciences portfolio over the budget planning horizon starting with the fiscal year 2009 budget does reflect the input of the decadal, and we will share that with you.

Senator MIKULSKI. Well, I am really excited to hear about that and, as both Senator Shelby and I have said, we have got a long road ahead. I think we are very clear that in 2008—ordinarily phrases like “stay the course” do not usually mean something, but we understand how—what we need to be doing in 2008. But we also want to look ahead to the longer issue, the NASA trend lines, as well as ensuring that we do have a reliable space transportation system as promptly as the Nation can afford to do it, as well as keeping other important projects.

I think we have really gone through quite a bit of our questions. Senator Shelby, do you have a last one?

RANKING MEMBER SHELBY CLOSING REMARKS

Senator SHELBY. I just have one brief comment since we have Dr. Griffin here again.

Dr. Griffin, we want to work with you, both of us. I work now as the ranking Republican, former chairman. Senator Mikulski was the former ranking Democrat, now chairman. But I do not believe that NASA has two bigger supporters than the two of us here on this subcommittee. We are going to continue to work with you to make NASA what it wants to be.

Dr. GRIFFIN. Thank you, Senator. I know that you have been my biggest supporters and I very much appreciate it.

SUBCOMMITTEE RECESS

Senator MIKULSKI. This subcommittee is recessed. We will return on April 12, when we will take testimony from the Attorney General.

[Whereupon, at 3:18 p.m., Thursday, March 15, the subcommittee was recessed, to reconvene subject to the call of the Chair.]